TFT LCD Approval Specification

MODEL NO.: V315B3 - LN1

Customer:_____

Approved by: _____

Note:

Approved By	TV Head Division	
	LY Chen	
Reviewed By	QRA Dept.	Product Development Div.
	Tomy Chen	WT Lin
Prepared By	LCD TV Marketing and Product Management Div.	
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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 2.0	Jun 24,'08	All	All	Approval Specification was first issued.
Ver 2.1	Dec 05,'08	7	3.2	Update max value of RSDS high input Voltage and min value of RSDS low input Voltage.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V315B3- LN1 is a 31.5" TFT Liquid Crystal Display module with 6U-CCFL Backlight unit and RSDS interface. This module supports 1366 x 768 WXGA format and can display 16.7M colors

1.2 FEATURES

-High brightness (450 nits)

- Ultra-high contrast ratio (2500:1)
- Faster response time (6.5ms)
- High color saturation NTSC 72%
- Ultra wide viewing angle : 176(H)/176(V) (CR>20) with Super MVA technology
- RSDS (Reduced Swing Differential Signaling) interface
- Color reproduction (nature color)
- Optimized response time for both 50 / 60 Frame rate

1.3 APPLICATION

- TFT LCD TVs
- Multi-Media Display

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	697.6845 (H) x 392.256 (V) (31.51" diagonal)	mm	(1)
Bezel Opening Area	703.8 (H) x 398.4 (V)	mm	
Driver Element	a-si TFT active matrix	-	
Pixel Number	1366 x R.G.B. x 768	pixel	
Pixel Pitch (Sub Pixel)	0.17025(H) x 0.51075 (V)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	16.7M	color	
Display Operation Mode	Transmissive mode / Normally black	-	
Surface Treatment	Anti-Glare coating (Haze 17%),Hard coating (3H)	-	

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	759	760	761	mm	(1)
	Vertical(V)	449	450	451	mm	(1)
	Depth(D)	40.5	41.5	42.5	mm	To Backside Emboss
Weight			6100		g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	(+50)	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

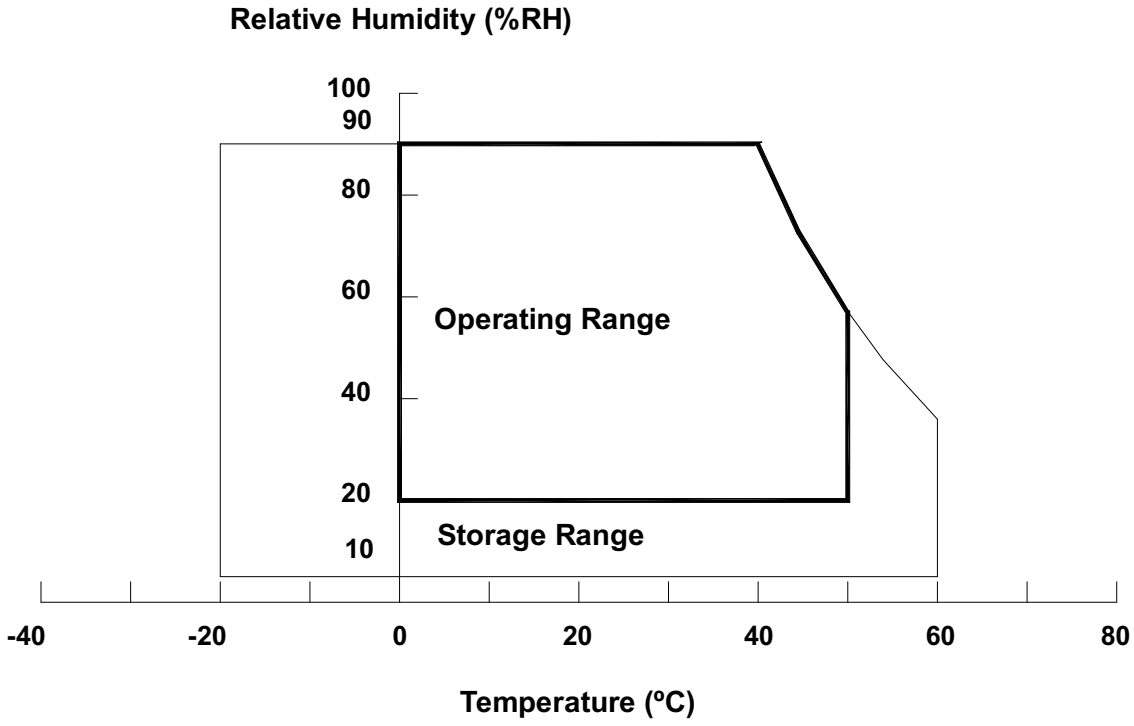
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

(a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃at normal humidity without condensation.

(b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	VDA	-0.3	+17.0	V	(1)
	VGHP	-0.3	+30.0	V	
	VGL	-10.0	-0.3	V	
Logic Input Voltage	VDD	-0.3	3.1	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

2.3.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_W	—	3000	V_{RMS}	
Power Supply Voltage	V_{BL}	0	30	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VGHP	22	23	24	V	
		VGL	-6.0	-5.5	-5.0	V	
		VDA	15.7	16	16.3	V	
		VDD	2.4	2.5	2.6	V	
		VREF	15.15	15.3	15.45	V	
Power Supply Current		IGH	-	10	-	mA	
		IGL	-	3	-	mA	
		IDA	-	220	-	mA	
		IDD	-	210	-	mA	
CMOS interface	Input High Threshold Voltage	V_{IH}	0.8VDD	-	VDD	V	
	Input Low Threshold Voltage	V_{IL}	0	-	0.2VDD	V	

3.2 RSDS CHARACTERISTICS

Ta = -10~+85 ºC

Item	Symbol	Condition	Value			Unit
			Min	Typ	Max	
RSDS high input Voltage	$V_{DIFFRSDS}$	V_{CMRSDS} = +1.2 V (1)	100	200	400	mV
RSDS low input Voltage	$V_{DIFFRSDS}$	V_{CMRSDS} = +1.2 V (1)	-400	-200	-100	mV
RSDS common mode input voltage range	V_{CMRSDS}	$V_{DIFFRSDS}$ = 200mV (2)	VSS+0.1	Note(3)	VDD-1.2	V
RSDS Input leakage current	I_{DL}	$D_{xx}P$, $D_{xx}N$,CLKO ,CLPN	-10	-	10	μA

Note (1) V_{CMRSDS} = (VCLKP + VCLKN)/2 or V_{CMRSDS} = ($VD_{XX}P$ + $VD_{XX}N$)/2

Note (2) $V_{DIFFRSDS}$ = VCLKP - VCLKN or $V_{DIFFRSDS}$ = $VD_{XX}P$ - $VD_{XX}N$

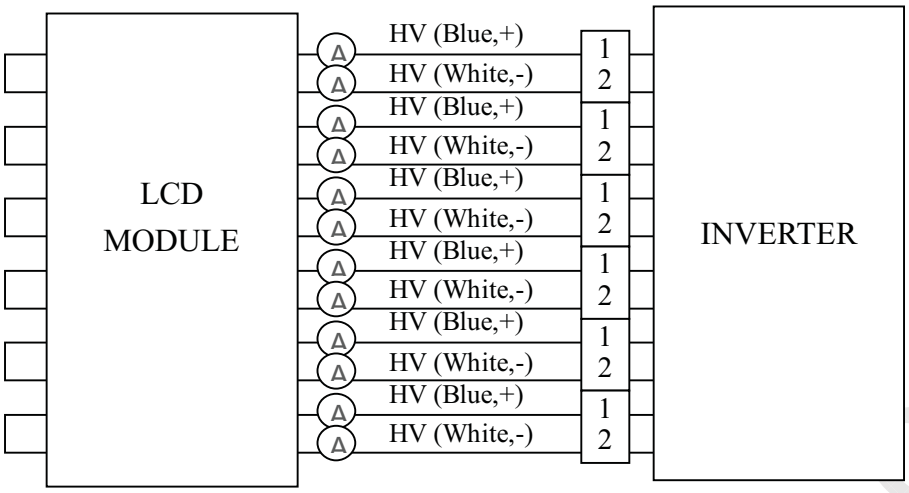
Note (3) V_{CMRSDS} = 0.8V(VDD = 2.5V)

3.3 BACKLIGHT INVERTER UNIT

3.3.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS (Ta = 25 ± 2 ºC)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Voltage	V_W	-	1800	-	V_{RMS}	I_L = 9.5mA
Lamp Current(HI-Side)	I_L	9.2	9.5	9.8	mA_{RMS}	(1)
Lamp Starting Voltage	V_S	-	3200	-	V_{RMS}	(2), Ta = 0 ºC
		-	2800	-	V_{RMS}	(2), Ta = 25 ºC
Operating Frequency	F_O	40	-	70	KHz	(3)
Lamp Life Time	L_{BL}	50,000		-	Hrs	(4)

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:



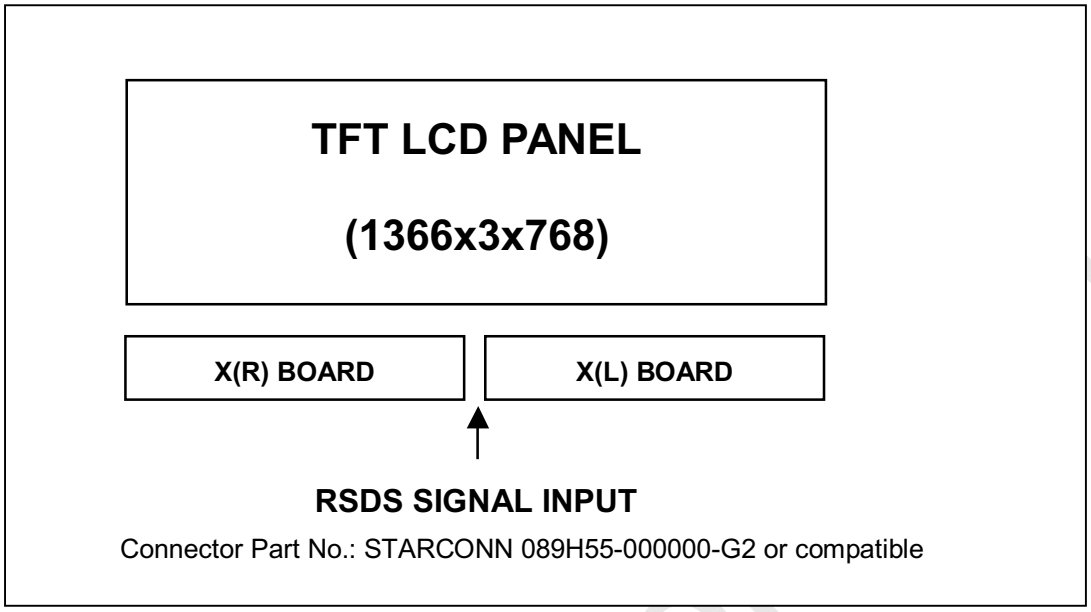
Note (2) The lamp starting voltage V_S should be applied to the lamp for more than 1 second under starting up duration. Otherwise the lamp could not be lighted on completed.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at Ta = 25 ±2℃ and I_L = I_L = 9.2 ~ 9.8 mA_{RMS}.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. PIN CONNECTION

5.1 TFT LCD MODULE

Pin assignment

CN1(XL) Connector Pin Assignment

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	TR2	trace 2 (3)	29	B2N	RSDS data signal (Blue 2)
2	TR1	trace 1 (2)	30	B1P	RSDS data signal (Blue 1)
3	GND	Ground	31	B1N	RSDS data signal (Blue 1)
4	GM14	Gamma Power supply	32	B0P	RSDS data signal (Blue 0)
5	GM13	Gamma Power supply	33	B0N	RSDS data signal (Blue 0)
6	GM12	Gamma Power supply	34	CLKP	Data driver clock
7	GM11	Gamma Power supply	35	CLKN	Data driver clock
8	GM10	Gamma Power supply	36	G2P	RSDS data signal (Green 2)
9	GM9	Gamma Power supply	37	G2N	RSDS data signal (Green 2)
10	GM8	Gamma Power supply	38	G1P	RSDS data signal (Green 1)
11	GM7	Gamma Power supply	39	G1N	RSDS data signal (Green 1)
12	GM6	Gamma Power supply	40	G0P	RSDS data signal (Green 0)
13	GM5	Gamma Power supply	41	G0N	RSDS data signal (Green 0)
14	GM4	Gamma Power supply	42	R2P	RSDS data signal (Red 2)
15	GM3	Gamma Power supply	43	R2N	RSDS data signal (Red 2)
16	GM2	Gamma Power supply	44	R1P	RSDS data signal (Red 1)
17	GM1	Gamma Power supply	45	R1N	RSDS data signal (Red 1)
18	VCM	VCM Power supply	46	R0P	RSDS data signal (Red 0)
19	VDA	Driver Power supply	47	R0N	RSDS data signal (Red 0)
20	VDA	Driver Power supply	48	GND	Ground
21	VREF	Gamma Power supply	49	STV_R	Scan driver start pulse 2
22	VDD	Logic Power supply	50	STV	Scan driver start pulse 1
23	EIO4	The fourth source driver start pulse	51	CKV	Scan driver clock
24	STH	The first source driver start pulse	52	OE	Scan driver output enable
25	TP1	RSDS data latch	53	VGL	Driver Power supply
26	POL	polarity invert	54	VGH	Driver Power supply
27	GND	Ground	55	GND	Ground
28	B2P	RSDS data signal (Blue 2)			

CN2(XR) Connector Pin Assignment

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	GND	Ground	29	R1P	RSDS data signal (Red 1)
2	GM14	Gamma Power supply	30	R2N	RSDS data signal (Red 2)
3	GM13	Gamma Power supply	31	R2P	RSDS data signal (Red 2)
4	GM12	Gamma Power supply	32	G0N	RSDS data signal (Green 0)
5	GM11	Gamma Power supply	33	G0P	RSDS data signal (Green 0)
6	GM10	Gamma Power supply	34	G1N	RSDS data signal (Green 1)
7	GM9	Gamma Power supply	35	G1P	RSDS data signal (Green 1)
8	GM8	Gamma Power supply	36	G2N	RSDS data signal (Green 2)
9	GM7	Gamma Power supply	37	G2P	RSDS data signal (Green 2)
10	GM6	Gamma Power supply	38	CLKN	Data driver clock
11	GM5	Gamma Power supply	39	CLKP	Data driver clock
12	GM4	Gamma Power supply	40	B0N	RSDS data signal (Blue 0)
13	GM3	Gamma Power supply	41	B0P	RSDS data signal (Blue 0)
14	GM2	Gamma Power supply	42	B1N	RSDS data signal (Blue 1)
15	GM1	Gamma Power supply	43	B1P	RSDS data signal (Blue 1)
16	VCM	VCM Power supply	44	B2N	RSDS data signal (Blue 2)
17	VDA	Driver Power supply	45	B2P	RSDS data signal (Blue 2)
18	VDA	Driver Power supply	46	GND	Ground
19	VREF	Gamma Power supply	47	DRL	Control the direction of start pulse
20	VDD	Logic Power supply	48	STV	Scan driver start pulse 1
21	STH_R	source driver start pulse reverse	49	VSCM	VSCM Power supply
22	EIO4	The fourth source driver start pulse	50	NC	No connection
23	TP1	RSDS data latch	51	VGL	Driver Power supply
24	POL	polarity invert	52	NC	No connection
25	GND	Ground	53	GND	Ground
26	R0N	RSDS data signal (Red 0)	54	TR4	trace 4 (2)
27	R0P	RSDS data signal (Red 0)	55	TR3	trace 3 (3)
28	R1N	RSDS data signal (Red 1)			

Note (1) CN1、CN2 Connector Part No.: STARCONN 089H55-000000-G2-C or equal.
Note (2) The TR1 must be connected to the TR4.
Note (3) The TR2 must be connected to the TR3.

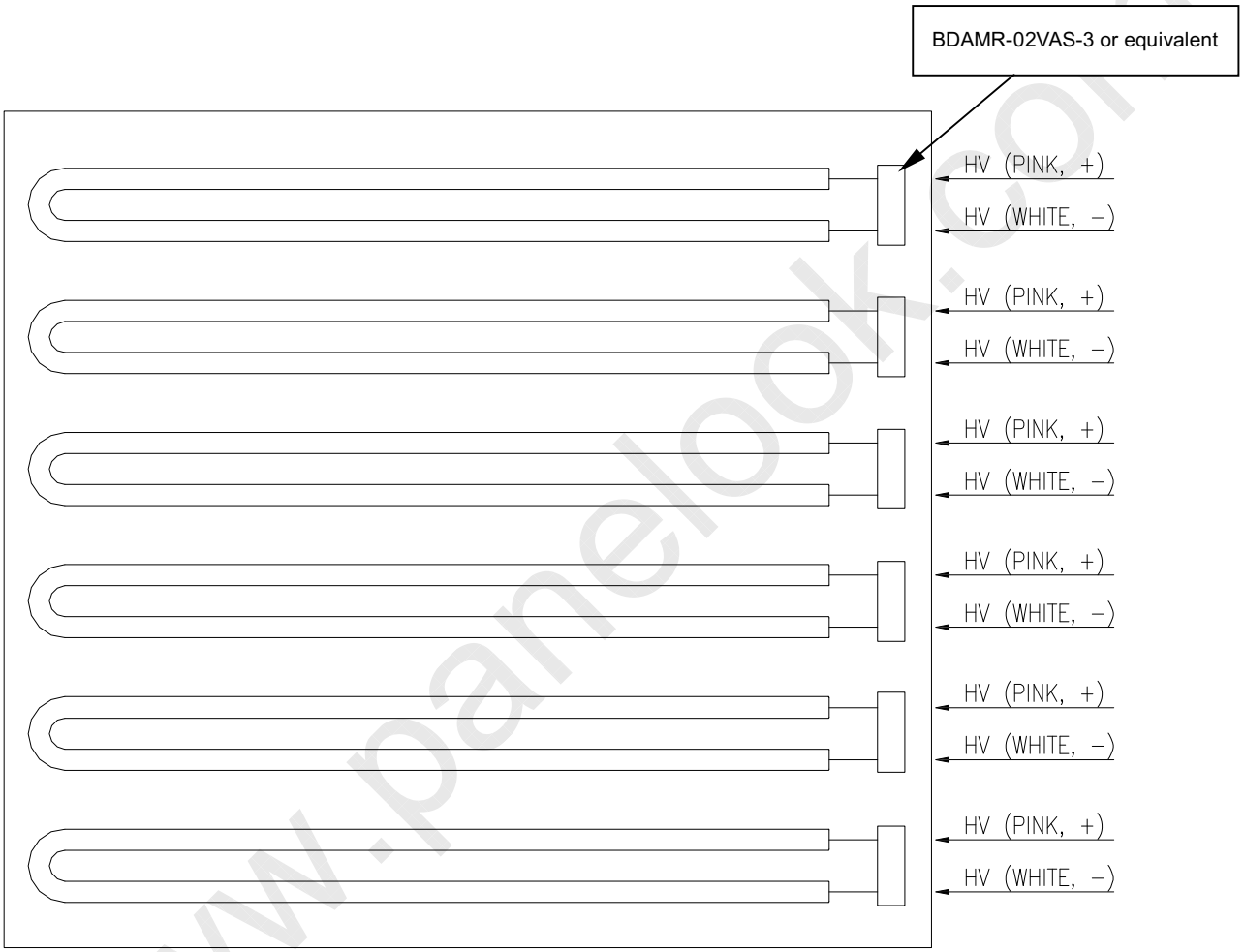
5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

CN2-CN7 (Housing): BDAMR-02VAS-3 or equivalent

Pin No.	Symbol	Description	Wire Color
1	HV	High Voltage	PINK
2	HV	High Voltage	WHITE

Note (1) The backlight interface housing for high voltage side is a model BDAMR-02VAS-3, manufactured by JST or equivalent. The mating header on inverter part number is SM02-BDAS-3-TB



5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

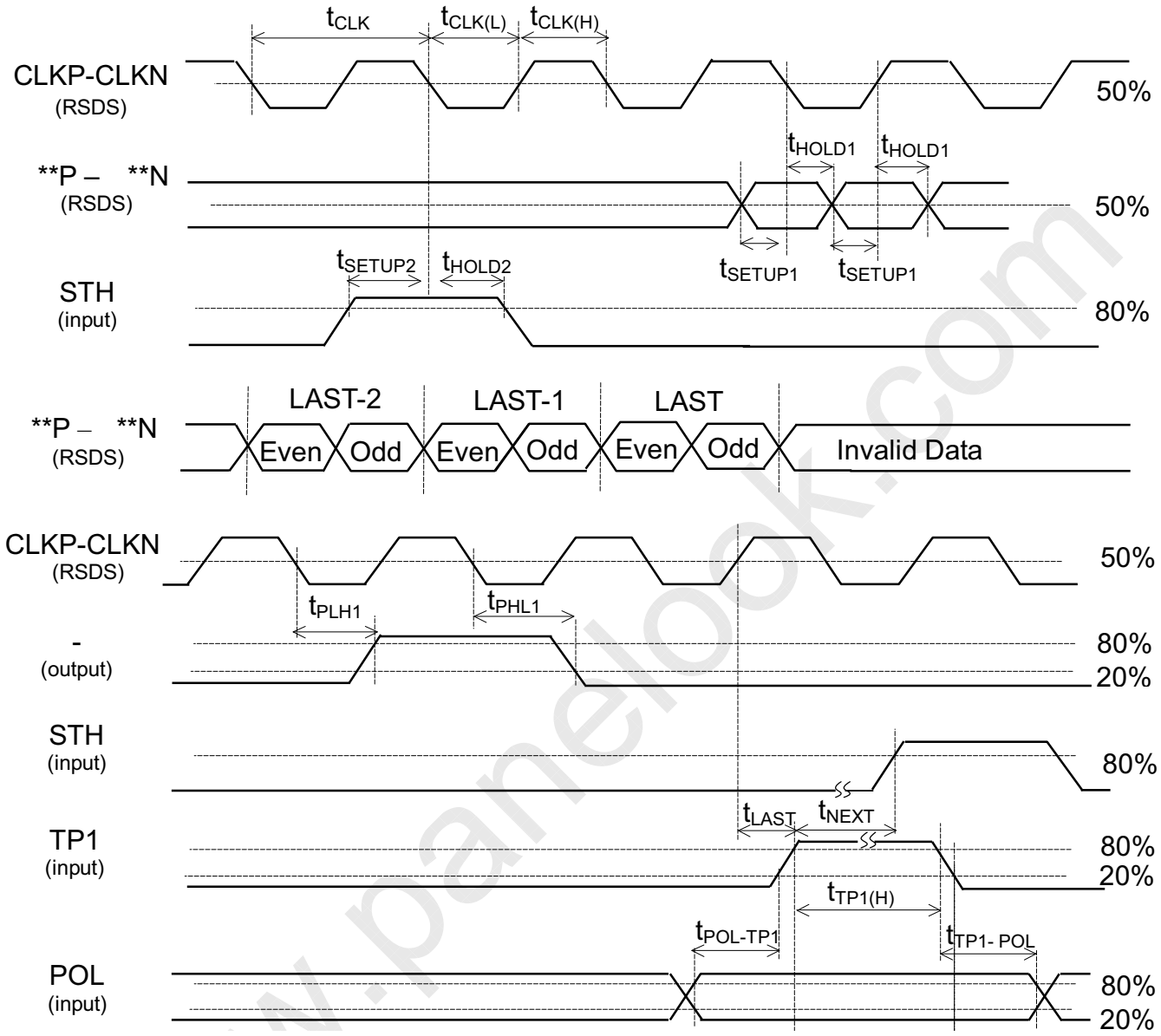
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

(a) Timing Spec

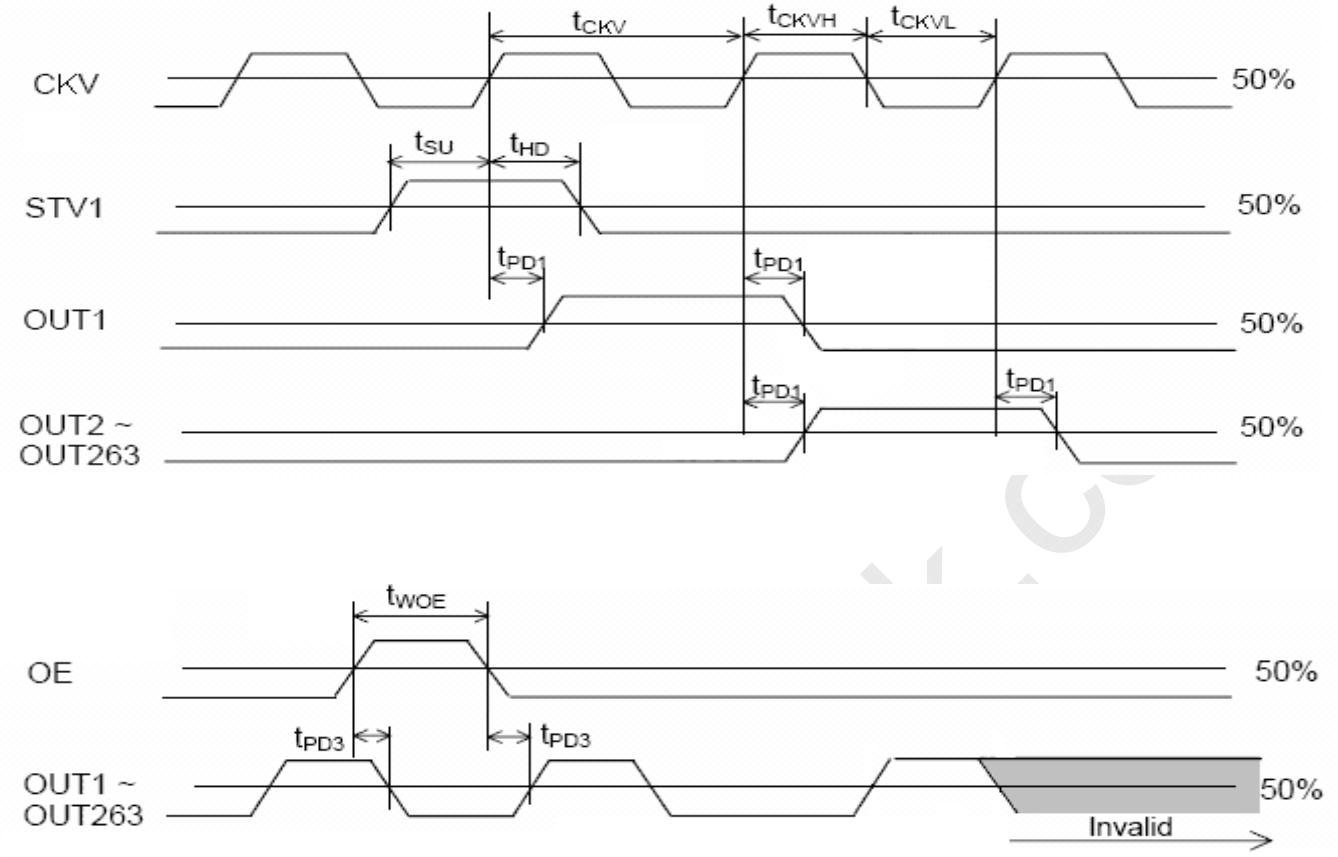
	Parameter	Symbol	Condition	Spec			Unit
				Min.	Typ.	Max.	
HD	Clock pulse width	t_{CLK}	-	11.8(1)	-	-	ns
	Clock pulse low period	$t_{CLK(L)}$	-	5	-	-	ns
	Clock pulse high period	$t_{CLK(H)}$	-	5	-	-	ns
	Data setup time	t_{SETUP1}	-	2	-	-	ns
	Data hold time	t_{HOLD1}	-	0	-	-	ns
	Start pulse setup time	t_{SETUP2}	-	1	-	-	ns
	Start pulse hold time	t_{HOLD2}	-	2	-	-	ns
	TP1 high period	$t_{TP1(H)}$	-	15	-	-	CLKP
	Last data CLK to TP1 high	t_{LAST}	-	1	-	-	CLKP
	TP1 high to STH high	t_{NEXT}	-	6	-	-	CLKP
	POL to TP1 setup time	$t_{POL-TP1}$	POL toggle to TP1 rising	3	-	-	ns
	TP1 to POL hold time	$t_{TP1-POL}$	TP1 falling to POL toggle	2	-	-	ns
VD	CKV period	t_{CKV}	-	5	-		μs
	CKV pulse width	t_{CKVH}, t_{CKVL}	50% duty cycle	2	-		μs
	OE pulse width	t_{WOE}	-	1	-		μs
	Data setup time	t_{SU}	-	0.5	-		μs
	Data hold time	t_{HD}	-	0.5	-		μs
	CKV to output delay time	t_{PD1}	CL=300pF	-	-	1	μs
	OE to output delay time	t_{PD3}	CL=300pF	-	-	0.8	μs

Note (1) : When operation frequency=85MHz

(b) Horizontal Timing Chart(b) Horizontal Timing Chart



(C)Vertical Timing Chart

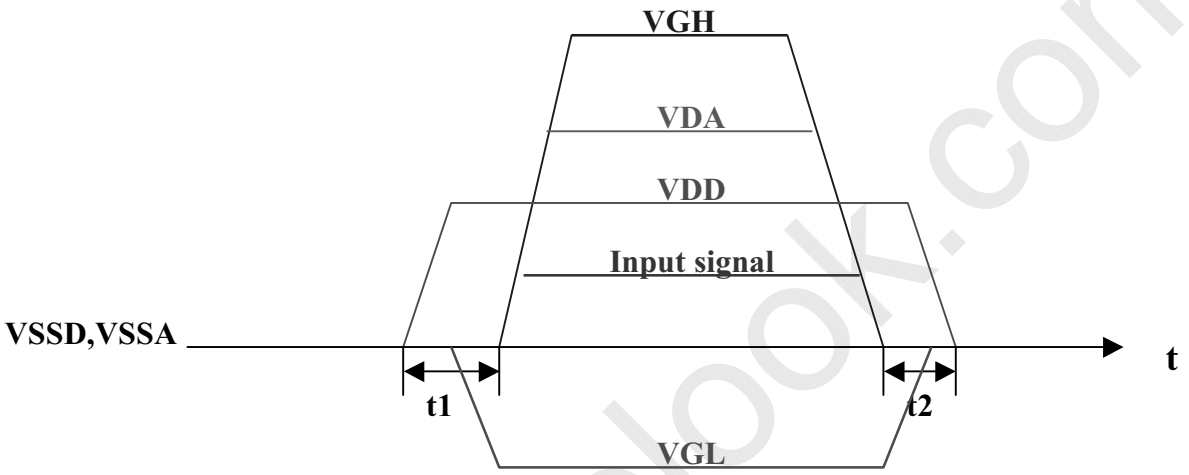


6.2 POWER ON/OFF SEQUENCE

To prevent the device from damage due to latch up , the power ON/OFF sequence shown below must be followed.

When power on : VDD → VGL → VDA → VGH , Input signal (t1＞0)

When power off : Input signal , VGH → VDA → VGL → VDD (t2≧0)



7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current (High side)	I_L	9.5mA ± 0.7	mA
Oscillating Frequency (Inverter)	F_W	66±3	KHz
Frame rate		60	Hz

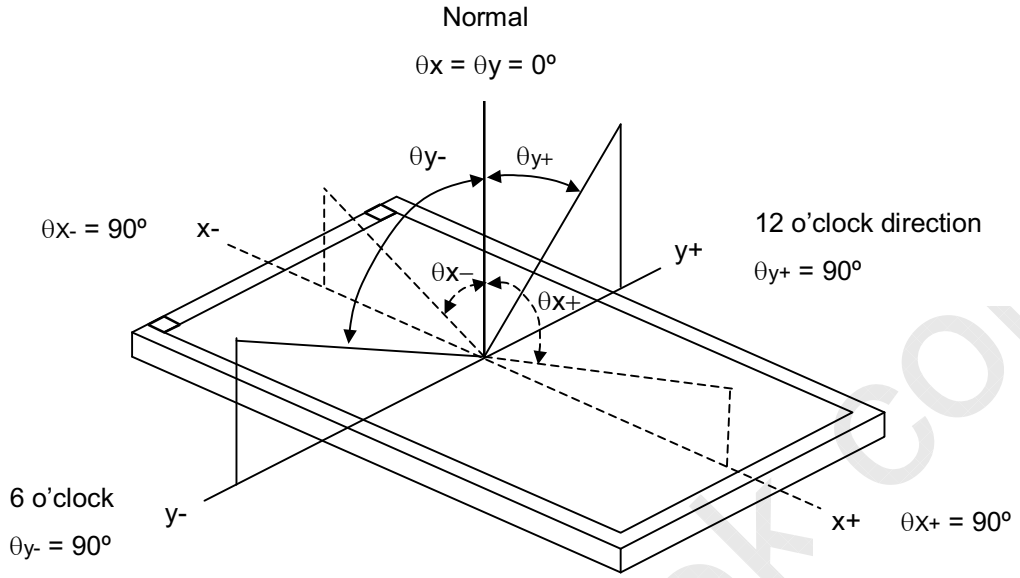
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Angle at Normal Direction	1500	2500	-	-	(2)
Response Time		Gray to gray average		-	6.5	12	ms	(3)
Center Luminance of White		L_C		400	450	-	cd/m^2	(4)
White Variation		δW		-	-	1.3	-	(7)
Cross Talk		CT		-	-	4.0	%	(5)
Color Chromaticity	Red	Rx		Typ -0.03	0.639	Typ +0.03	-	(6)
		Ry			0.331		-	
	Green	Gx			0.270		-	
		Gy			0.591		-	
	Blue	Bx			0.146		-	
		By			0.063		-	
	White	Wx			0.280		-	
		Wy			0.290		-	
	Color Gamut	CG		68	72		%	NTSC
Viewing Angle	Horizontal	θ_x+	CR≥20	80	88	-	Deg.	(1)
		θ_x-		80	88	-		
	Vertical	θ_Y+		80	88	-		
		θ_Y-		80	88	-		

-Note (1)Definition of Viewing Angle (θx, θy):

Viewing angles are measured by EZ-Contrast 160R (Eldim)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

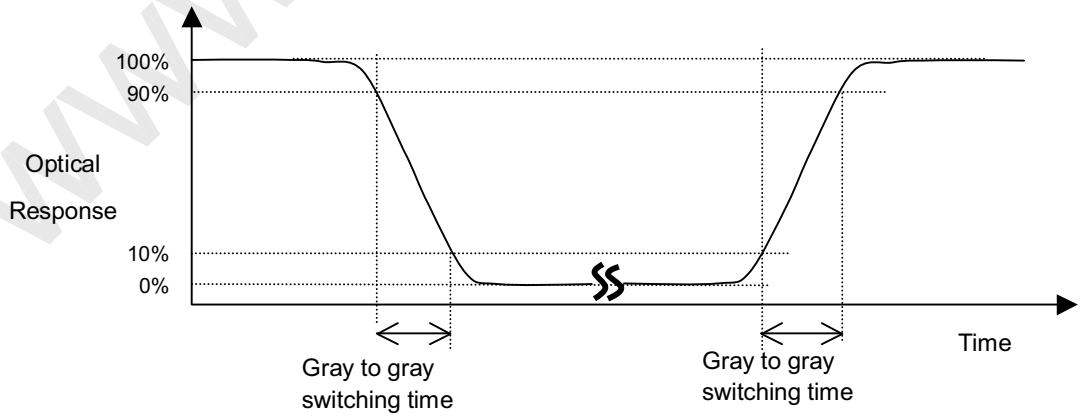
Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of luminance 0%, 20%, 40%, 60%, 80%, 100%.

Gray to gray average time means the average switching time of luminance 0%,20%, 40%, 60%, 80%, 100% to each other.

Note (4) Definition of Luminance of White (L_C, L_{AVE}):

Measure the luminance of gray level 255 at center point and 5 points

$L_C = L(5)$

$L_{AVE} = [L(1)+ L(2)+ L(3)+ L(4)+ L(5)] / 5\_delteted.$

where L (x) is corresponding to the luminance of the point X at the figure in Note (7).

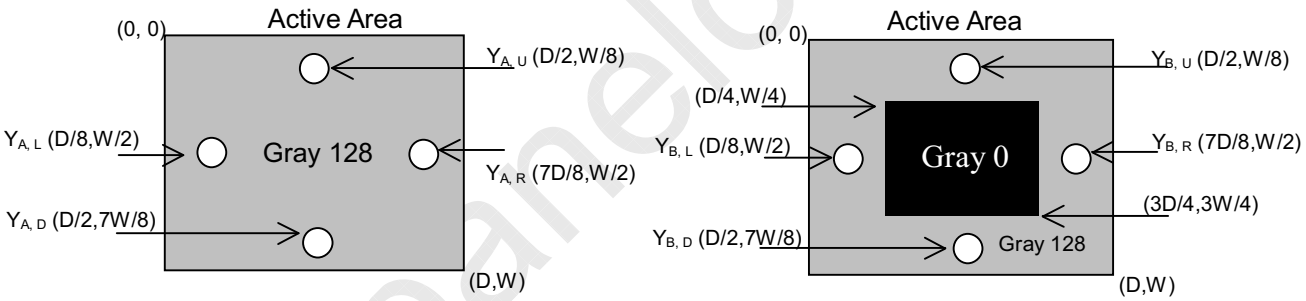
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B – Y_A | / Y_A \times 100\ (\%)$

Where:

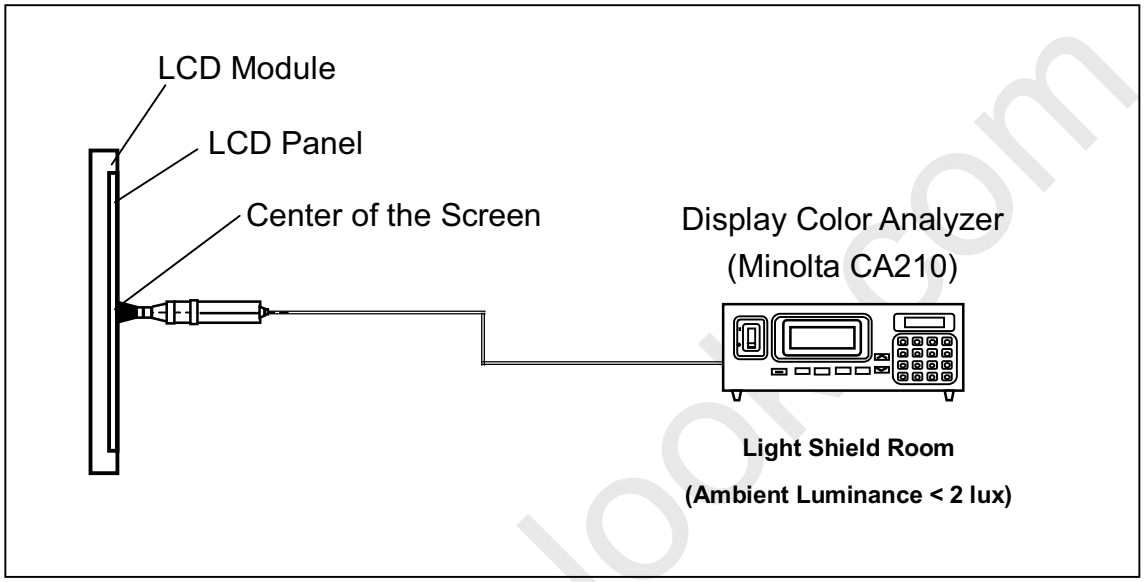
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

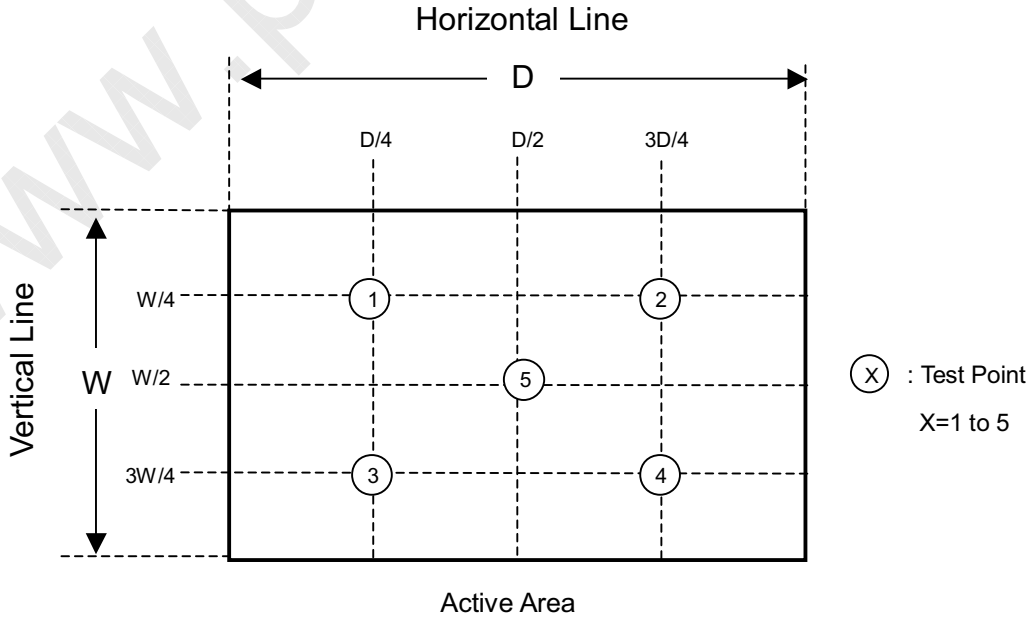
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

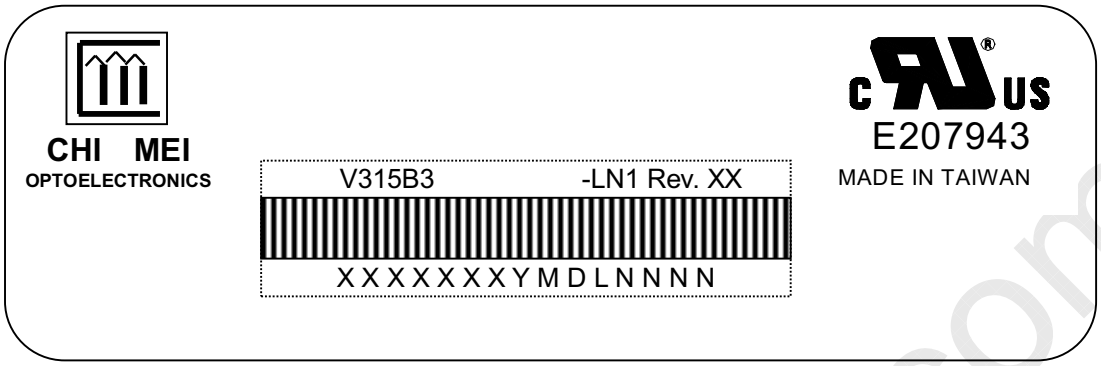
δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



8. DEFINITION OF LABELS

8.1 CMO MODULE LABEL

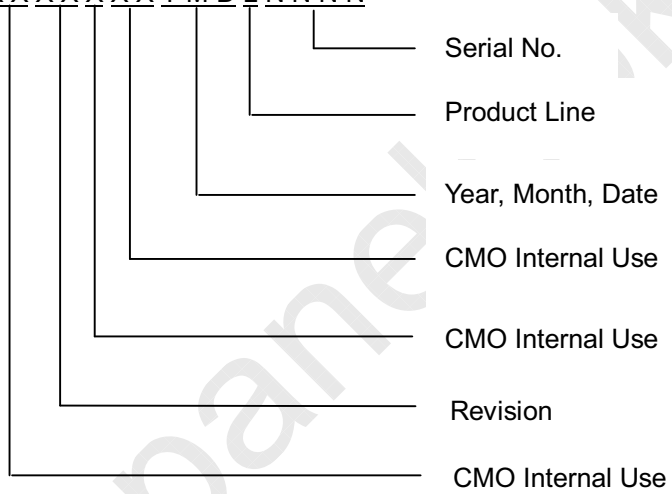
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: V315B3-LN1

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009
Month: 1~9, A~C, for Jan. ~ Dec.
Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

(b) Revision Code: Cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

9. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 5 LCD TV modules / 1 Box

(2) Box dimensions : 834(L) X 380 (W) X 530 (H)

(3) Weight : approximately 38.5Kg (5 modules per box)

9.2 PACKING METHOD

Figures 9-1 and 9-2 are the packing method

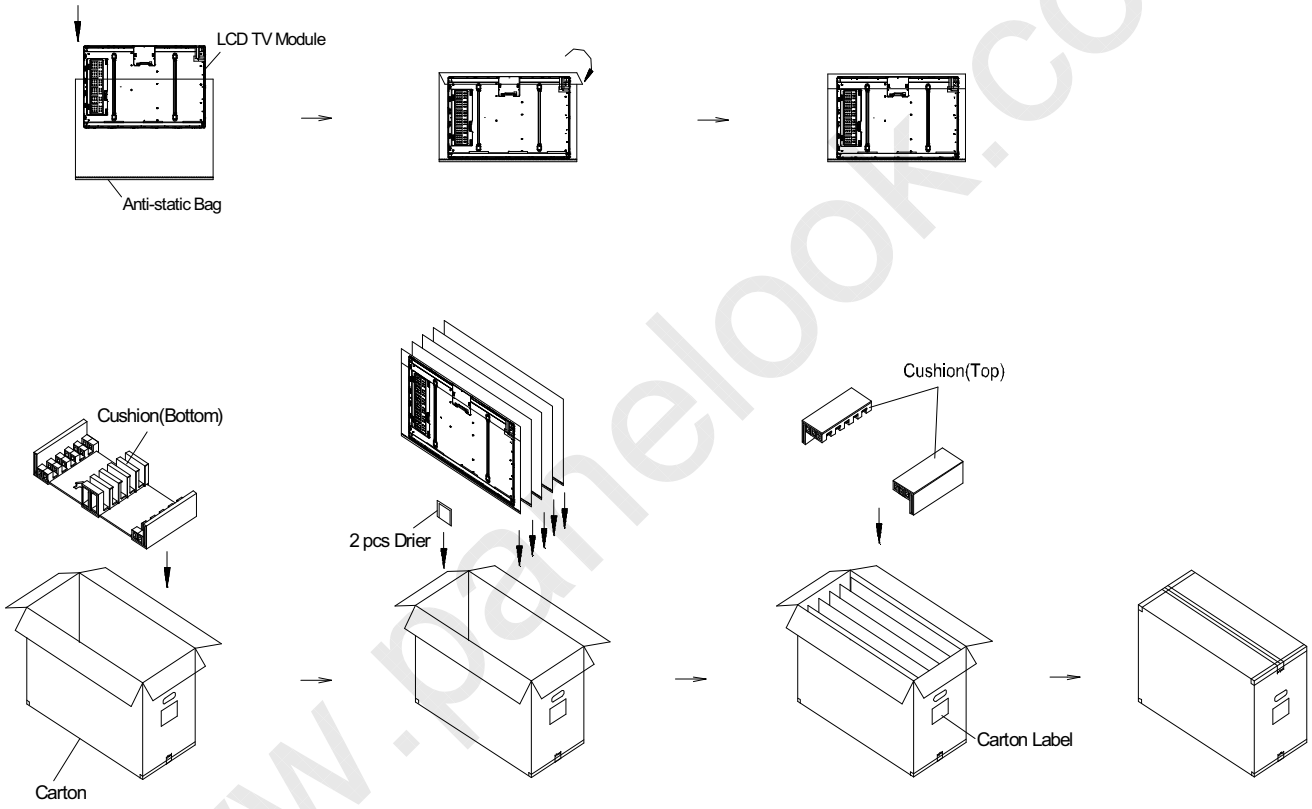
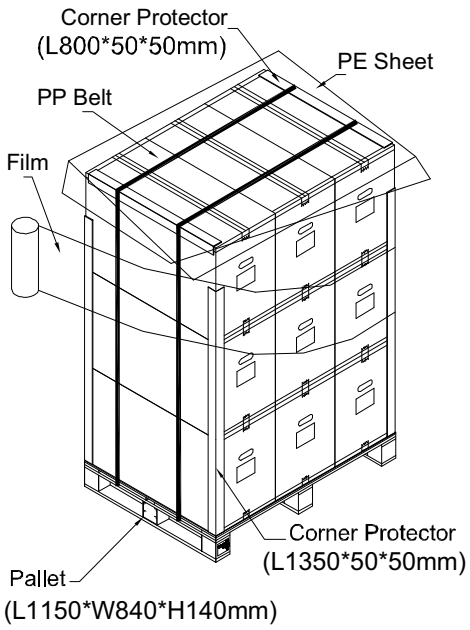
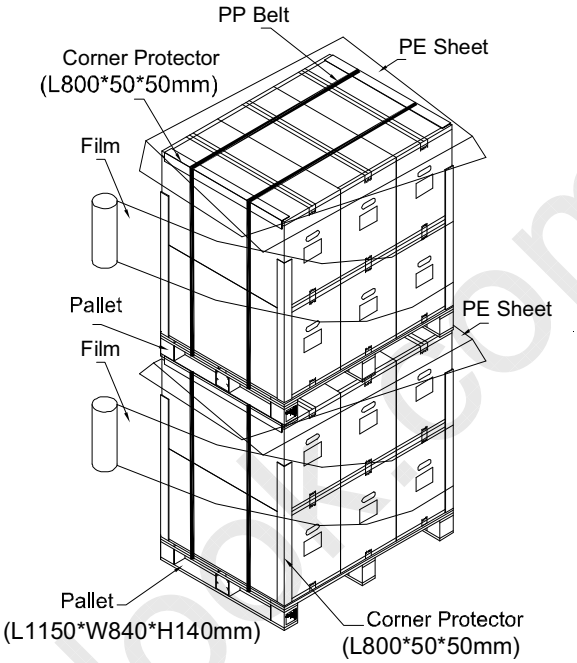


Figure.9-1 packing method

Sea / Land Transportation
(40ft Container)



Sea / Land Transportation
(40ft HQ Container)



Air Transportation

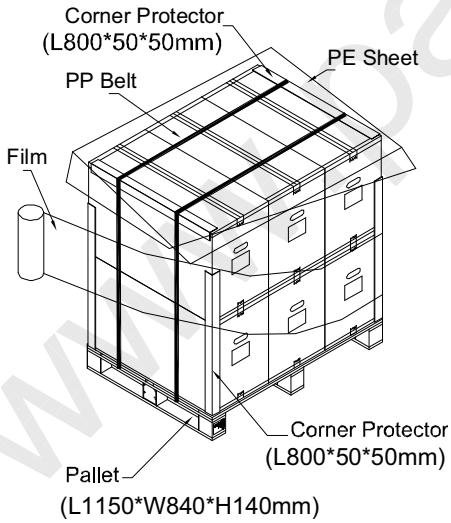


Figure.9-2 packing method

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.

(4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

(5) Do not plug in or pull out the I/F connector while the module is in operation.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

10.2 SAFETY PRECAUTIONS

(1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

10.3 STORAGE PRECAUTIONS

When storing modules as spares for a long time, the following precaution is necessary.

(1) Do not leave the module in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35℃at normal humidity without condensation.

(2) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

11. MECHANICAL CHARACTERISTICS